MACIEJ KOS, PH.D.

BROOKLINE, MA

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Previously: Google, Roku, Philips Healthcare Research

RESEARCH INTERESTS

NIH/NIA Career Awardee | Data Scientist & Computer Scientist developing innovative solutions for cognitive health using mHealth, wearables, and computational modeling. Expertise in applying these methods to create digital biomarkers, evaluate the effectiveness and dose-response of behavioral interventions (including physical activity), inform just-in-time adaptive interventions (JITAIs), and advance quantitative health research. Adaptable methodological skills applicable across diverse health domains.

EDUCATION

Northeastern University, Khoury College of Computer Sciences — 2024

Ph.D. in Personal Health Informatics (GPA: 4.0/4.0) — Boston, MA

- Dissertation: Digital biomarkers of cognitive health: unobtrusive monitoring of cognitive changes using smartphones
- Committee: Drs. Misha Pavel, Stephen Intille, Holly Jimison, Art Kramer, and Joseph Kvedar

University of Michigan, School of Information — 2012

M.A. in Information Science — Ann Arbor, MI

Barcelona Graduate School of Economics — 2009

M.Sc. in Economics of Science and Innovation — Barcelona, Spain

SKILLS

- **Programming & Data Science:**
  - **Programming:** Python, R, Stata, SQL (GCP BigQuery, AWS Athena; database administration and efficient querying of petabyte scale datasets.)
  - **Statistics:** GLM (univariate, multivariate, some multilevel), SEM, psychometric modeling, time series, repeated measures/longitudinal analysis
  - **Machine Learning/AI:** dimensionality reduction, clustering, SVMs, ridge regression, logistic classification, random forests, sequential pattern mining, LLM few-shot learning
  - **Other:** data visualization, network analysis, wearables, GPS data, behavioral modeling, mixed-methods UX research
- **Research Methods & Domain Expertise:**
  - **Digital Biomarker Development**: Designing and validating algorithms to extract health-relevant metrics from sensor data (esp. cognitive health, stress).
  - **Wearable Sensors & mHealth Data**: Expertise in collecting, processing, and analyzing data from smartphones and wearables (Accelerometers, PPG, EDA, GPS).

- **Experimental Design**: Designing laboratory and ambulatory studies involving human participants, including cognitive/behavioral tasks and intervention components.
- **Human Subjects Research Ops**: preparation of IRB protocols, recruitment (including online ads), data collection management, and ethical considerations.
- **Data Visualization**: Creating informative plots and dashboards for analysis and communication.
- **Behavioral Modeling**: Experience with data-driven, statistical and mechanistic modeling of human behavior, and simulations

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RESEARCH EXPERIENCE, ACADEMIA

Northeastern University Center for Cognitive and Brain Health 6/2024–

Postdoctoral Research Fellow Boston, MA

- NIH NIA Career Award recipient (K00)
- Leads a DIGITAL BIOMARKERS research project on detecting changes in cognitive health using unobtrusively collected smartphone data by combining neuro approaches with data science, AI, and mechanistic modeling methods. **These digital biomarkers hold potential for unobtrusively monitoring cognitive trajectories and objectively measuring the impact of interventions aimed at preventing cognitive decline.**
- Research Partners: Boston University's Precision Brain Health Initiative (PI: Au), Northeastern University's Laboratory for the Scientific Study of Dance (PI:McCullough), University of Massachusetts Boston's Brain Stimulation & Simulation Lab (PI: Rampersad)

Northeastern University Khoury College of Computer Sciences 9/2015 – 3/2024

Graduate Researcher Boston, MA

"**Digital Biomarkers of Cognitive Health**" (Dissertation), with Dr. Pavel and Dr. Rampersad

- To infer cognitive changes, I developed software and algorithms for collecting and analyzing smartphone data collected passively (location and motion, typing speed and frequency of errors, app use, and screen events).
- Designed cognitive lab experiments, including cognitive and motor tasks and EEG.
- Recruited, trained, and managed a team of five research assistants; secured their funding.

"**Measurement of collective physical distancing during the COVID-19 outbreak using large-scale mobility data**" in collaboration with the MOBS lab, PI: Alessandro Vespignani

- Developed an approach for reducing selection bias in smartphone location data of over 40 million US users by combining well-established statistical techniques with multivariate simulations applied to geospatial sociodemographic data (Python, R).
- Helped build a pipeline for processing over 0.5 petabytes of data (Python, BigQuery).

"**Strengthening Human Adaptive Reasoning and Problem-solving**" in collaboration with Harvard, Oxford, and HoneyWell

- Built a statistical model to characterize the relationship between different types of brain stimulation, estimates of fluid intelligence, and performance during adaptive cognitive training (R).
- Helped develop a computational model of participants' performance during adaptive cognitive training (R).

"**WearTech - determining the accuracy of wearable sensors for ambulatory stress monitoring**"

- Used machine learning and signal processing techniques to develop a method for removing motion artifacts from heart rate data (R).
- The developed method improved upon Microsoft's state-of-the-art algorithm.

RESEARCH EXPERIENCE, INDUSTRY

Roku 6/2021 – 9/2021

Research Data Scientist Intern Remote

"**Development and assessment of algorithms for creating lookalike audiences (ads)**"

- Implemented and assessed machine learning methods for creating lookalike audiences using behavioral data (lift > 20x).
- Proposed novel algorithms for lookalike creation.

Google 5/2019 – 9/2019

User Experience Research Intern (quant) San Francisco, CA

"**Quantification of Material Design (Google's open-source design system)**"

- Developed an algorithm for computing websites' cognitive complexity based on Shannon's entropy.
- Prototyped analytics pipeline to parse 400 billion pages and fuses Google's diverse signals about each website (e.g., vertical, location, reach).

Philips Healthcare Research 5/2018 – 9/2018

Research Intern (Clinical Data Analytics) Cambridge, MA

"**Intensive care unit of the future: health informatics technologies for preventing critical illness brain injury (CIBI)**"

- Proposed and prototyped system architectures and UX of two clinical decision support systems for preventing delirium and CIBI using ICU data.
- Submitted two patent applications (internally).

Agile Axons (self-employed) 1/2013 – 8/2015

User Experience and Research Consultant Poland and Rome, Italy

- Led a UX team developing a consumer-facing mobile app for a large Italian telco (with **McKinsey** and **Ericsson**).
- Consulted on research design and statistical programming for behavioral finance and economics projects.

TEACHING EXPERIENCE

Northeastern University Khoury College of Computer Sciences 2018, 2023–2024

Postdoctoral Research Fellow (2024-), Ph.D. student(-2024) Boston, MA

- DS2001: Data Science Programming – Instructor of Record (Fall 2024)
- DS2001: Data Science Programming & DS2000: Programming with Data – Teaching Assistant (Fall 2023)
- HDA6400: Health Data Analytics – Teaching Assistant (Fall 2018)
- Mentorship:
  - Guided three graduate students through completing their data science capstone project

- Mentored a graduate student in health data analytics and an undergraduate student in computer science

University of Gdansk E-Business Program at the Economics Department 2006–2009

Assistant Lecturer and Researcher Sopot, Poland

- Web Usability and Human-Computer Interaction: Instructor of Record
- Internet Marketing and Online Communities: Instructor of Record
- Mentorship:
  - Mentored two teams of graduate students participating in the Google Online Marketing Challenge; one of the teams won first place in Poland
  - Advised 20 undergraduate students on their thesis projects

AWARDS (SELECTED)

- NIH National Institute on Aging: K00 Career Award 5/2024 – 5/2028 (PI; 307,649 USD total costs)
- NIH National Institute on Aging: Transition to Aging Research F99 Predoctoral Fellowship 9/2020 – 8/2023 (PI; 92,532 USD total costs)
- Harvard John A. Paulson School of Engineering and Applied Sciences, Institute for Applied Computational Science, 2022 – tuition waiver to participate in Harvard Bedrock Machine Learning courses
- Association for Computing Machinery HPC/Intel Corporation Computational and Data Sciences Fellowship, 2017 – 2020 (15,000 USD annually)
- Google Scholarship, 2020 (10,000 USD)
- Graduate Cohort Workshop for Underrepresented Minorities, 2020 – Computing Research Association Travel Award
- Grace Hopper Conference, 2019 – Google travel award
- Complex Physical, Biological & Social Systems Winter School at New England Complex Systems Institute, MIT, Cambridge, MA, 2019 – tuition waiver
- Disability: IN, 2017 - NextGen Leader award
- Barcelona Graduate School of Economics, 2008/2009 – merit-based full tuition waiver (12,000 EUR)

GRANTS (SELECTED)

- Network Science Institute Seed Grant Program, 2021 (10,000 USD) – grant for exploratory research on "App Networks Analysis for Developing a Digital Biomarker of Cognitive Health"
- Northeastern University Tier I grant, 2020 (approx. 50,000 USD) – grant for developing digital biomarkers using smartphone data; co-PIs Dr. Rampersad and Dr. Pavel
- Northeastern University Dissertation Research Grant, 2019 (3,000 USD)
- Polish National Science Center, 2013 (77,000 USD) – research grant to study why individuals often avoid actionable genetic health risk information; I wrote the Research Strategy for the application that won the largest grant awarded to researchers at the host economics department (before beginning my Ph.D. program at Northeastern University)
- Erasmus Life-long Learning Grant, 2008 (1,900 EUR)
- University of Gdansk, 2007 (2,000 USD) – research grant to characterize usability of academic websites
- Erasmus Socrates Mobility Grant, 2005 (1,850 EUR)

ACADEMIC SERVICE

- Editorial Board Member: npj Digital Medicine (Nature Portfolio)
- Ad hoc reviewer for:
  - SIG Human-Computer Interaction
  - IEEE Engineering in Medicine and Biology Society
  - American Medical Informatics Association
  - PLOS ONE
  - Journal of Gerontology: Psychological Sciences
- Boston University and Framingham Heart Study Brain Aging Program, 2025 – co-organizer of the 5th Annual FHS-BAP Virtual Symposium on the Exposome and Alzheimer's Disease and Related Disorders
- Northeastern Personal Health Informatics Faculty Committee, 2018/2019 – elected student representative
- Personal Health Informatics seminar, 2016/2018 – organizer (with C. Gordon and S. Ólafsson)
- Rackham's International Connect, 2010/2011 – mentor
- Poland Foresight 2020 national research program – external expert
- Barcelona Graduate School of Economics, 2008/2009 – student representative
- E-business Science Association, 2006-2008 – chair at the University of Gdansk
- Baltic Science Festival, 2007/2008 – departmental coordination team member

PROFESSIONAL ASSOCIATIONS

- Association for Computing Machinery
- IEEE
- Digital Medicine Society (DiMe)
- American Medical Informatics Association

RESEARCH CATEGORIES LEGEND

AI/ML **Artificial Intelligence/Machine Learning**
Beh.Mod **Behavioral Modeling**
Cog.Hlth **Cognitive Health**
Cog.Int **Cognitive Interventions**
Dec.Mkg **Decision-Making**
Dig.Bio **Digital Biomarkers & Monitoring**
UX **User Experience (UX)**
Wear.Sens **Wearable Sensing**
m.Hlth **Mobile Health**

PUBLICATIONS (PEER-REVIEWED, SELECTED)

1. Pindus, D.M., Paluska, S., So, J., Wyczesany, M., Ligeza, T.S., Sarol, J., Kuang, J., Quiroz, F.B., Shanmugam, R., Syed, T., **Kos, M.**, Khan, N., Hillman, C., & Kramer, A. (2025). *Breaking prolonged sitting with high-intensity interval training to improve cognitive and brain health in middle-aged and older adults: a protocol for the pilot feasibility HIIT2SITLess trial.* BMJ Open, 15(5), e095415, https://doi.org/10.1136/bmjopen-2024-095415 Cog.Hlth Cog.Int

2. Pindus, D.M., Lloyd, K.M., Ligeza, T.S., Askow, A., McKenna, C., Bashir, N., Martin, H., Quiroz, F.B., Montero Herrera, B., Cannavale, C., Kuang, J., Yu, Q., **Kos M.**, Brown, C.S., von Ash, T., Zou, L., Burd, N.A., Khan, N.A., Kramer, A.F., & Hillman, C.H. (2025). *Interrupting sitting with moderate-intensity physical activity breaks improves cognitive processing speed in adults with overweight and obesity: Findings from the SITLess pilot randomized crossover trial.* International Journal of Psychophysiology. p.112519, https://doi.org/10.1016/j.ijpsycho.2025.112519 — Cog.Hlth, Cog.Int

3. Peller, S.L., Marcotte, A.M., Wells, C.S., Press, N., **Kos, M.**, (2025). *Teacher training, coaching and school libraries in rural indigenous Guatemala: A multi-pronged approach to improving reading proficiency.* International Journal of Educational Research Open, 8, p.100437. https://doi.org/10.1016/j.ijedro.2025.100437 — Beh.Mod

4. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Gonzalez R., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi (2024). *Characterizing the collective physical distancing of the United States during the first nine months of the COVID-19 pandemic.* PLOS Digit Health 3(2): e0000430. https://doi.org/10.1371/journal.pdig.0000430 — AI/ML, Beh.Mod, m.Hlth

5. Pavel M., Caves K., Jarvis L., Hasson C.J., **Kos M.**, Jimison H. (2021). *Unobtrusive, Continuous LIDAR-Based Measurement of Gait Characteristics at Home.* 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), pp. 2339-2342. IEEE — Dig.Bio, Wear.Sens

6. Khaghani-Far, I., Li, X., **Kos M.**, Gordon, C. M., Williams, H., Pavel, M., & Jimison, H. B. (2019). *NUCoach: A Customizable Coaching Platform for Designing Rehabilitation Mobile Apps.* Archives of Physical Medicine and Rehabilitation, 100(7), e2. — AI/ML, m.Hlth, UX

7. **Kos M.**, Li X., Khaghani-Far I., Gordon C., Pavel M., Jimison H. (2017). *Can accelerometry data improve estimates of heart rate variability from wrist PPG sensors?* Paper presentation at the 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, South Korea. — AI/ML, Dig.Bio, Wear.Sens

8. Blajer-Golebiewska, A. and **Kos M.** (2016). *Investors are more sensitive to information about financial rather than ethical reputation of a company: evidence from an experimental study.* Economics & Sociology, 9(1), p.11. — Beh.Mod, Dec.Mkg

9. **Kos M.** (2013). *Structural and behavioral determinants of play in a repeated network coordination game – preliminary report.* Contemporary Economy Economic Scientific Journal, 3(4), 43-69. — Beh.Mod, Dec.Mkg

10. **Kos M.** (2010). *Business aspects of user-centric design.* In J. Winiarski (Ed.), E-commerce. University of Gdansk Print House. — UX

CONFERENCE PRESENTATIONS (PEER-REVIEWED, SELECTED)

1. **Kos M.**, Pavel M., Jimison H. (2019). *How to Validate Heart Rate Monitoring Wearables for Just-in-Time Adaptive Health Interventions? Development of Comparison Testing Guidelines.* Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC. — Dig.Bio, m.Hlth, Wear.Sens

2. **Kos M.**, Ponnada A., Pavel M., Intille S. (2018). *Evidence That Microinteraction Ecological Momentary Assessment (μEMA) is a Non-Reactive In-Situ Affect Assessment Method.* Poster presentation at the 2019 Society for Affective Science Annual Conference in Boston, MA. — Beh.Mod, m.Hlth, UX

3. Rampersad S., Orhan K., **Kos M.**, Mansfield K., Marghi Y. M., Sheffield J., Dillard M., Erdogmus D., Pascual-Leone A., Yeung N., Mathan S., Cohen K. R., Pavel M. (2018). *Effects of EEG-Based Closed-Loop Transcranial* — AI/ML, Cog.Hlth, Cog.Int, Wear.Sens

Alternating Current Stimulation on Theta Power during a Cognitive Task. Poster presentation at the 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Hawaii.

4. **Kos M.**, Gordon C., Li X., Khaghani-Far I., Pavel M., Jimison H. (2017). *The Accuracy of Monitoring Stress from Wearable Devices.* Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC. Cog.Hlth Dig.Bio Wear.Sens

CONFERENCES AND WORKSHOPS (NOT PEER-REVIEWED)

1. **Kos M.**, Babula E., Kołatka M., Mrzygłód U., Wach D. (2022). *Characterization of the reflection effect across DOSPERT risk content domains.* Poster presentation at the Society for Judgment and Decision-Making annual conference, San Diego, IL, virtual Beh.Mod Dec.Mkg
2. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi M. (2020). *Reshaping a nation: Mobility, commuting, and contact patterns during COVID-19.* Presentation at COVID-19 Satellite of Sunbelt XL, International Sunbelt Social Network Conference, virtual m.Hlth Beh.Mod AI/ML
3. **Kos M.** (2020). *Towards a digital biomarker of cognitive health: passive monitoring of cognitive changes using smartphone-based data.* Poster presentation at the Computing Research Association Grad Cohort Workshop, Austin, TX. Cog.Hlth Dig.Bio m.Hlth
4. **Kos M.**, Yew J. (2019). *Computational methods for understanding cognitive density preferences; foundations for adaptive user experiences*, Google Ph.D. Intern Research Conference, Mountain View, CA. Beh.Mod UX
5. McKanna J., **Kos M.**, Plessow F., Dillard M., Almquist J., Kimball G., Myers E., Orhan U., Rampersad S., Marghi Y., Cornhill D., Brem A., Mansfield K., Yeung N., Thompson T., Santarnecchi E, Erdogmus E., Pascual-Leone A., Kadosh C. R., Mathan S., Pavel M. (2017). *Components of cognition: identifying contributors to learning speed in a game training intervention.* Poster presentation at xTech, San Francisco, CA. Beh.Mod Cog.Int
6. **Kos M.**, McKanna J., Pavel M., Dillard M., Almquist J., Kimball G., Brem A., Orhan U., Rampersad S., Cornhill D., Yeung N., Erdogmus D., Pascual-Leone A., Kadosh R., Mathan S. (2017). *The impact of stimulus features on learning and accuracy in an adaptive category learning task designed to train fluid intelligence,* Poster presentation at the Association for Psychological Science annual convention, Boston, MA. Beh.Mod Cog.Int
7. **Kos M.**, Blajer-Gołębiewska A., Wach D., Pavel M., Gonzalez R. (2016). *Decision-making under threat: what determines our engagement in preventive behaviors?* Poster presentation at the Society for Judgment and Decision-Making annual conference, Boston, MA. Beh.Mod Dec.Mkg
8. **Kos M.**, Blajer A., Wach D. (2015). *When do we avoid health-risk information?* Poster presentation at the Society for Judgment and Decision-Making annual conference, Chicago, IL. Beh.Mod Dec.Mkg
9. **Kos M.**, Blajer A., Wach D. (2015). *Identifying predictors of preventive behaviors using a financially incentivized experiment – a pilot study.* Poster presentation at the 37th Annual North American Meeting of Society for Medical Decision Making, St. Louis, MO. Beh.Mod Dec.Mkg
10. Blajer A., Wach D., **Kos M.** (2015). *When inducing affective decision-making statistical significance may be not enough,* Oral presentation at the 10th Nordic Conference on Behavioral and Experimental Economics, Tampere, Finland. Beh.Mod Dec.Mkg

11. **Kos M.**, Blajer A., Wach D. (2015). *When do individuals avoid potentially life-saving risk information?* Poster presentation at the Subjective Probability, Utility, Decision Making conference, Budapest, Hungary.

Beh.Mod
Dec.Mkg

BOOK CHAPTERS (NOT PEER-REVIEWED)

1. Jimison, H., **Kos M.**, Pavel, M. (2022). *Early Detection of Cognitive Decline Via Mobile and Home Sensors.* In: Hsueh, PY.S., Wetter, T., Zhu, X. (eds) Personal Health Informatics. Cognitive Informatics in Biomedicine and Healthcare. Springer, Cham. Online version: https://rdcu.be/c1niL

Cog.Hlth
Dig.Bio
m.Hlth
Wear.Sens